COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINERAL RESOURCES

EXPOSED AND INFERRED EARLY MESOZOIC BASINS ONSHORE AND OFFSHORE, VIRGINIA

Gerald P. Wilkes, Stanley S. Johnson, and Robert C. Milici

1989

AEROMAGNETIC MAP

PUBLICATION 94, PLATE 1
EXPOSED AND INFERRED EARLY MESOZOIC BASINS
ONSHORE AND OFFSHORE, VIRGINIA
AEROMAGNETIC MAP

Table 2. Basement drill holes.

INDEX NUMBER	DRILL HOLE NAME	TD (FEET)	BASEMENT (FEET)	TD LITHOLOGY
W-56	WW	425	71	GRANITE
W-70	WW	173	170	GRANITE
W-158	FORT MONROE	2255	2246	GRANITE
W-180	ELKINS/PHILLIPS #1	2325	2307	GRANITE
W-335	WW	306	227	GRANITE
W-539	WW	239	26	GRANITE GNEISS
W-584	WW	300	250	GRANITE
W-587	WW	297	70	GRANITE GNEISS
W-763	WW	265	60	MARBLE
W-781	WW	226	185	GRANITE GNEISS
W-935	WW	199	150	GRANITE
W-953	WW	350	180	GRANITE
W-960	WW	325	125	GRANITE
W-961	WW	475	275	GRANITE
W-969	WW	608	276	GRANITE
W-997	WW	220	44	GRANITE
W-1116	WW	318	145	GRANITE
W-1123	WW	262	257	GRANITE
W-1187	WW	126	100	GRANITE
W-1194	WW	175	95	GRANITE
W-1198	WW	600	50	GRANITE
W-1210	WW	577	90	GRANITE GNEISS
W-1230	WW	295	210	GRANITE
W-1297	WW	234	158	GRANITE
W-1300	WW	334	290	GRANITE
W-1305	WW	508	200	GRANITE
W-1388	WW	525	324	GRANITE
W-1472	WW	395	260	GRANITE
W-1477	WW	227	190	GRANITE
W-1507	WW	108	30	GRANITE
W-1508	WW	393	130	GRANITE GNEISS
W-1510	WW	224	160	GRANITE
W-1533	WW	295	90	GRANITE
W-1534	WW	350	104	GRANITE
W-1541	WW	402	70	GRANITE
W-1553	WW	230	104	GRANITE
W-1634	WW	925	913	GRANITE
W-1687	WW	132	98	GRANITE
W-1753	WW	400	175	GRANITE
W-1791	WW	632	320	GRANITE GNEISS
W-1800	WW	708	250	GRANITE
W-1878	WW	640	170	GRANITE
W-1906	WW	78	20	GRANITE
W-1907	WW	118	50	GRANITE
W-1908	WW	140	120	GRANITE
W-1936	WW	143	140	GRANITE
W-2068	WW	322	83	GRANITE
W-2221	WW	300	185	GRANITE
W-2227	WW	154	60	GRANITE
W-2229	WW	355	50	GRANITE
W-2237	WW	260	188	GRANITE
W-2248	WW	218	100	GRANITE
W-2253	WW	886	770	PHYLLITE, SCHIST
W-2325	SPAIN LUMBER CO. #2	599	530	GRANITE
W-2417	WW	600	220	GRANITE
W-2478	WW	282	109	GRANITE
W-2500	WW	653	150	GRANITE
W-2572	WW	96	10	GRANITE
W-2655	WW	310	60	GRANITE
W-2656	WW	136	132	GRANITE
W-2719	IMPERIAL OIL COMPANY	535+	?	GRANITE
W-2720	VA. OIL & GAS CO.	265	200(?)	GRANITE
W-2751	WW	330	78	GRANITE
W-2756	WW	250	69	GRANITE
W-2757	WW	250	103	GRANITE
W-2841	WW	451	306	GRANITE
W-2926	WW	250	60	GRANITE
W-2927	WW	335	112	GRANITE
W-2932	WW	400	30	GRANITE
W-3088	WW	372	220	GRANITE
W-3220	OW	554	405	CRYSTALLINE
W-3250	WW	237	110	GRANITE
W-3277	WW	250	86	GRANITE
W-3366	WW	405	165	GRANITE
W-3367	WW	300	170	GRANITE
W-3411	WW	294	285	PHYLLITE
W-3542	WW	290	150	GRANITE
W-3570	WW	225	50	GRANITE GNEISS
W-3609	LIPPERT/GADDY #1-B	2426	570(?)	SCHIST)
W-3579	WW	330	200	GRANITE
W-3649	WW	200	27	GRANITE
W-3654	WW	200	10	SCHIST
W-3680	WW	350	50	GRANITE
W-3791	WW	431	240	GRANITE GNEISS
W-3821	WW	592	300	GRANITE GNEISS
W-3824	WW	310	68	GRANITE
W-3900	WW	504	500	GRANITE
W-3901	WW	627	527	GRANITE
W-3902	WW	159	155	GRANITE
W-4055	WW	122	40	GRANITE
W-4069	WW	340	111	PHYLLITE
W-4162	WW	505	60	GRANITE
W-4165	WW	370	50	GRANITE
W-4185	WW	80	10	GRANITE
W-4387	WW	375	40	GRANITE
W-4394	WW	367	170	GRANITE
W-4397	WW	292	270	GRANITE GNEISS
W-4444	WW	165	10	GRANITE
W-4505	WW	445	40	GRANITE
W-4540	WW	240	40	GRANITE
W-4541	WW	206	60	METASLTSTONE
W-4762	WW	205	125	GRANITE
W-4890	WW	318	313	GRANITE
W-4894	WW	190	50	GRANITE
W-4906	WW	92	20	GRANITE
W-5019	WW	250	20	GRANITE
W-5078	WW	632	109	GRANITE
W-5081	WW	402	220	GRANITE
W-5139	WW	357	60	GRANITE
W-5191	WW	400	50	GRANITE
W-5223	WW	360	110	GRANITE
W-5341	WW	357	60	GRANITE
70	DOE/PT1	832	300	GRANITE
71	DOE/C25A	2009	1800	GRANITE
72	DOE/C26	1628	1380	GRANITE
73	MGS/AA-CC 78	917	908	GNEISS
74	MGS/AA-CC 114	1025	1017	GNEISS
75	MGS/PG-CF 53	1172	1162	GRANITE
76	MGS/AA-CE 120	1340	1290	FELSIC
77	MGS/QA-EB 110	2548	2518	WEATHERED
78	WGL/DENNISON #3	1743	1707	GNEISS
79	WGL/THORNE #2	1478	1433	GNEISS
80	MGS/CH-BE 57	1802	1791	SCHIST
81	MGS/CH-DA 6	886	882	SCHIST
82	MGS/DO-CE 88	3337	3304	GNEISS
83	MGS/SM-DF 84	2678	2623	DIABASE
84	OHIO HAMMOND #1	5568	5498	GNEISS
85	MOBIL/BETHARDS #1	7178	7130	GABBRO
86	MGS/SO-DD 47	5562	4225	METAVOLCANIC
87	NASA	2088	?	RHYOLITE

ABBREVIATIONS

A&R = A & R OIL COMPANY
CORNELL = CORNELL OIL COMPANY
DOE = UNITED STATES DEPARTMENT OF ENERGY
ELKINS = ELKINS OIL AND GAS COMPANY
GRAY = GRAY LUMBER COMPANY
J&J= J & J ENTERPRISES, INC.
JSC= JSC DRILLING COMPANY
MERRILL = MERRILL NATURAL RESOURCES, INC.
MGS= MARYLAND GEOLOGICAL SURVEY
MOBIL= MOBIL OIL CORPORATION
NASA= NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OW= OBSERVATION WELL
PHILLIPS = PHILLIPS COAL COMPANY
ROBERTS= ROBERTS DRILLING COMPANY
SHORE = SHORE PETROLEUM COMPANY
SOLITE= SOLITE CORPORATION
TEXACO = TEXACO, USA
TIDEWATER = TIDEWATER OIL AND GAS CORPERATION
USGS= UNITED STATES GEOLOGICAL SURVEY
VULCAN = VULCAN MATERIALS COMPANY
WGL= WASHINGTON GAS LIGHT COMPANY
WW = WATER WELL

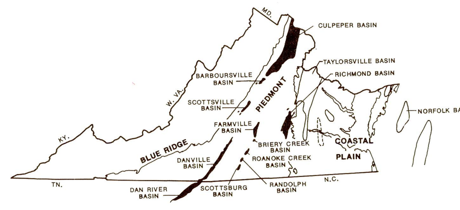


Figure 1. Location of Early Mesozoic basins in Virginia; Richmond basin includes Deep Run, Tuckahoe, Union, and Stonehenge basins. Dashed basin outline indicates location of probable basin.

Table 1. Drill holes encountering Early Mesozoic rocks.

INDEX NUMBER	DRILL HOLE NAME	TD (FEET)	CRETACEOUS MESOZOIC CONTACT(FEET)	BASEMENT (FEET)	TD LITHOLOGY
W-457	ROBERTS/TOWNSEND #1	3278	1009	2609	GNEISS
W-515	WW	1689	1320		SANDSTONE
W-616	WW	712	249		SANDSTONE
W-1921	WW	440	90		ARKOSE
W-2071	WW	652	640		SANDSTONE
W-2252	JSC/THOMPSON #1	3307	2210	3297(?)	BASALT
W-2335	A&R/MARTIN #1A	620			SANDSTONE
W-2336	A&R/MARTIN #1B	520			SANDSTONE
W-2340	WW	325			SANDSTONE
W-2683	WW	540	510		SANDSTONE
W-3180	J&J/TAYLOR #1-G	6279	5006	6134	SCHIST
W-3316	OW	2017	1920		SANDSTONE
W-3374	WW	325	100		MUDSTONE
W-3443	WW	340	220		SANDSTONE
W-3574	WW	610	460		SANDSTONE
W-3903	WW	404	280		MUDSTONE
W-3904	WW	600	512		MUDSTONE
W-4159	WW	297	37		MUDSTONE
W-4160	WW	370	50		MUDSTONE
W-4208	WW	420	229		MUDSTONE
W-4591	WW	220	210		MUDSTONE
W-6529	MERRILL/HUDGINS #1	2700			SILTSTONE
W-6530	MERRILL/GORDON #1	1820			SANDSTONE
W-6531	MERRILL/CASHION #2	1675		1620	CRYSTALLINE
W-6538	MERRILL/CONTINENTAL CAN #1	2700			"GRAVEL"
W-6567	MERRILL/CONTINENTAL CAN #4	2700			SANDSTONE
W-6568	MERRILL/CHALKLEY #1	1510		1190	CRYSTALLINE
W-6569	MERRILL/TURNER #1	2030			SANDSTONE
1	OW	1550	533		SANDSTONE
2	TEXACO/CAMPBELL #1	5550	499		SEDIMENTARY
3	TEXACO/BUTLER #1	5500	1065		SEDIMENTARY
4	TEXACO/PAYNE #1	5500	1290		SEDIMENTARY
5	TEXACO/ELLIS #1	5500	1580		SEDIMENTARY
6	TEXACO/FOGG #1	5500	1740		SEDIMENTARY
7	TEXACO/ROBERTS #1	3533	1945	3404	SCHIST
8	TIDEWATER/JOHR #1	860	?		SANDSTONE
9	MERRILL/GEORGIA PACIFIC #1	2320			SANDSTONE
10	MERRILL/TURNER #2	2770			SILTSTONE
11	SHORE/HICKS #1	4488+		4400+	CRYSTALLINE
12	SHORE/CHESAPEAKE #1	3080			SILTSTONE
13	CORNELL/HORNER #1	6329			SILTSTONE
14	RICHMOND SYNDICATE #3	487		486	GRANITE
15	RICHMOND SYNDICATE #4	584		524	GRANITE
16	RICHMOND SYNDICATE #5	487			SANDSTONE
17	RICHMOND SYNDICATE #7	2087			SANDSTONE
18	RICHMOND SYNDICATE #8	1072			SEDIMENTARY
19	RICHMOND SYN. SE HOLE	2337			SEDIMENTARY
20	SALISBURY DRILLHOLE	2380			SHALE
21	GRAY #1	1552			DIABASE
22	CORNELL/BAILEY #1	7438		7110	GRANITE
23	MERRILL/ADAMSON #1	2780		2770	GRANITE
24	PHILLIPS/SAUNDERS VAGO-1	557			SHALE
25	PHILLIPS/CARTER VAPW-2	510			SANDSTONE
26	PHILLIPS/CIEJEK VAPW-1	340			ARKOSE
27	VULCAN #1	106			SANDSTONE
28	VULCAN #2	80			SANDSTONE
29	PHILLIPS/ANDERSON AM-1	900		240	SLATE
30	PHILLIPS/GRAY LUMBER CS-2	1220			SILTSTONE
31	PHILLIPS/WALDROW VACH-2	501			ARKOSE
32	TIDEWATER/FORK #2	1550			SANDSTONE
33	FLOYD #1	900			SEDIMENTARY
34	PULLIAM #1	800 to 900			SEDIMENTARY
35	WILLIAMS #1	1200			SEDIMENTARY
36	WILLIS #1	400			SEDIMENTARY
37	SOLITE ASH-1	560			SHALE
38	SOLITE HAC-1	745			SANDSTONE
39	SOLITE HAC-2	183			SILTSTONE
40	USGS/DB-26	145			SILTSTONE
41	USGS/EC-10	858			SILTSTONE
42	USGS/51V-3E	1020			SILTSTONE
43	USGS/51V-24H	500			SILTSTONE
44	USGS/50T-16B	153			SILTSTONE
45	USGS/50S-2D	205			SILTSTONE
46	USGS/DC-31	285			SANDSTONE
47	USGS/DB-47	600			SANDSTONE
48	USGS/51V-14F	1002		610	SCHIST
49	USGS/51V-23H	1000			SANDSTONE
50	USGS/51V-5J	289			SANDSTONE
51	USGS/49U-11C	500			SANDSTONE
52	USGS/50V-70D	480			CONGLOMER.
53	USGS/50V-84D	175			CONGLOMER.
54	USGS/50W-13B	145			CONGLOMER.
55	USGS/47R-8A	700			CONGLOMER.
56	USGS/51U-2D	200			DIABASE
57	USGS/48R-4A	100			DIABASE
58	USGS/51U-3D	290			METAMORPH.
59	USGS/48S-15F	165			METAMORPH.
60	USGS/49U-30E	225			BASALT
61	USGS/48S-5B	255			BASALT
62	USGS/52V-1D	140		125	SCHIST
63	USGS/DC-59	262		105	SCHIST
64	USGS/CO-26	858		808	CAMB. LIMEST.
65	WGL/ROBERTS #2	1752	1720		SAND
66	WGL/MUDD #3	1725	1491		SHALE
67	WGL/ROBINSON #2	1818	1815(?)		MUDSTONE
68	WGL/BUTLER #2	1720	1615(?)	1660	GNEISS
69	MGS/CH-CE 37	2014	1915(?)		MESOZOIC(?)

KEY

Early Mesozoic basins

Exposed basins

Buried basins

Drill holes

Drill hole encountering Triassic rock (Table 1)

Drill hole encountering pre-Triassic crystalline basement rock (Table 2)

——— 11,000 ———

Onshore and Chesapeake Bay

Contours showing total intensity magnetic field of the earth in hundreds of gammas relative to arbitrary datum. Main magnetic field of the earth has been removed. Contour intervals 100 and 500 gammas. Light shading for areas with value less than 10,800 gammas. Darker shading indicates areas of local minimum intensity.

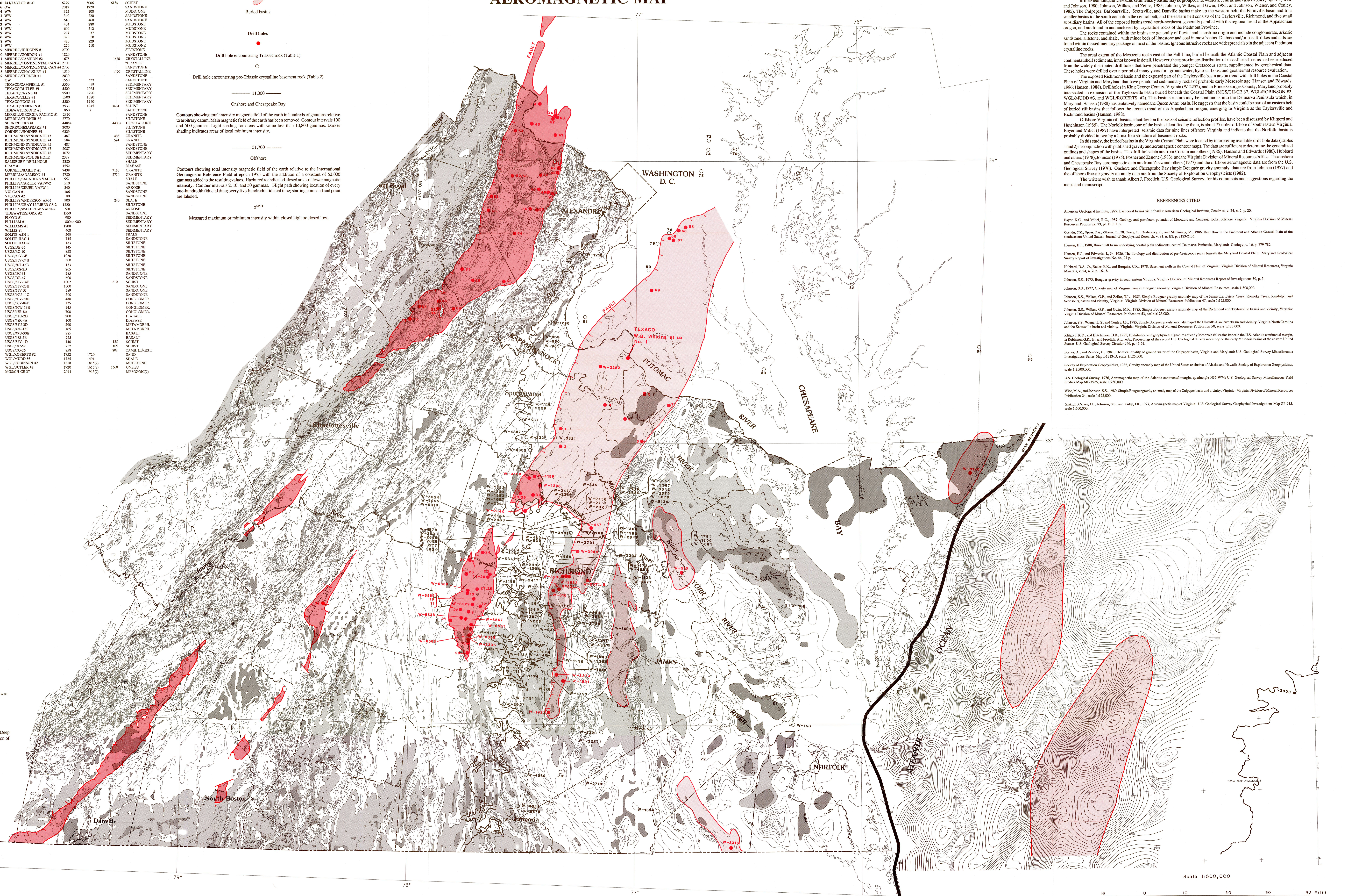
——— 51,700 ———

Offshore

Contours showing total intensity magnetic field of the earth relative to the International Geomagnetic Reference Field at epoch 1975 with the addition of a constant of 52,000 gammas added to the resulting values. Hachured to indicated closed areas of lower magnetic intensity. Contour intervals 2, 10, and 50 gammas. Flight path showing location of every one-hundredth fiducial time; every five-hundredth fiducial time; starting point and end point are labeled.

x 51514

Measured maximum or minimum intensity within closed high or closed low.



A belt of fault-controlled rift basins of early Mesozoic age lies along the east coast of North America from Florida to the Grand Banks of Newfoundland (American Geological Institute, 1979). The basins of this Atlantic Coast rift system contain Upper Triassic and Lower Jurassic continental rocks of the Newark Supergroup. Basinal structures were formed as the earth's crust was arched upward and then extended as Africa began to separate from North America during the earliest phase of the opening of the Atlantic Ocean. Subsequent sedimentation, lithification, and erosion have left, in Virginia, Mesozoic basins exposed in the Piedmont and concealed to the east beneath the younger Mesozoic and Cenozoic sedimentary strata of the Coastal Plain.

In the Piedmont, the Mesozoic sedimentary basins may be grouped into western, central, and eastern belts (Figure 1; Wise and Johnson, 1980; Johnson, Wilkes, and Zeiler, 1985; Johnson, Wilkes, and Gwin, 1985; and Johnson, Wiener, and Conley, 1985). The Culpeper, Barboursville, Scottsville, and Danville basins make up the western belt; the Farmville basin and four smaller basins to the south constitute the central belt; and the eastern belt consists of the Taylorsville, Richmond, and five small subsidiary basins. All of the exposed basins trend north-northeast, generally parallel with the regional trend of the Appalachian orogen, and are found in and enclosed by, crystalline rocks of the Piedmont Province.

The rocks contained within the basins are generally of fluvial and lacustrine origin and include conglomerate, arkosic sandstone, siltstone, and shale, with minor beds of limestone and coal in most basins. Diabase and/or basalt dikes and sills are found within the sedimentary package of most of the basins. Igneous intrusive rocks are widespread also in the adjacent Piedmont crystalline rocks.

The areal extent of the Mesozoic rocks east of the Fall Line, buried beneath the Atlantic Coastal Plain and adjacent continental shelf sediments, is not known in detail. However, the approximate distribution of these buried basins has been deduced from the widely distributed drill holes that have penetrated the younger Cretaceous strata, supplimented by geophysical data. These holes were drilled over a period of many years for groundwater, hydrocarbons, and geothermal resource evaluation.

The exposed Richmond basin and the exposed part of the Taylorsville basin are on trend with drill holes in the Coastal Plain of Virginia and Maryland that have penetrated sedimentary rocks of probable early Mesozoic age (Hansen and Edwards, 1986; Hansen, 1988). Drillholes in King George County, Virginia (W-2252), and in Prince Georges County, Maryland probably intersected an extension of the Taylorsville basin buried beneath the Coastal Plain (MGS/CH-CE 37, WGL/ROBINSON #2, WGL/MUDD #3, and WGL/ROBERTS #2). This basin structure may be continuous into the Delmarva Peninsula which, in Maryland, Hansen (1988) has tentatively named the Queen Anne basin. He suggests that the basin could be part of an eastern belt of buried rift basins that follows the arcuate trend of the Appalachian orogen, emerging in Virginia as the Taylorsville and Richmond basins (Hansen, 1988).

Offshore Virginia rift basins, identified on the basis of seismic reflection profiles, have been discussed by Klitgord and Hutchinson (1985). The Norfolk basin, one of the basins identified by them, is about 75 miles offshore of southeastern Virginia. Bayer and Milici (1987) have interpreted seismic data for nine lines offshore Virginia and indicate that the Norfolk basin is probably divided in two by a horst-like structure of basement rocks.

In this study, the buried basins in the Virginia Coastal Plain were located by interpreting available drill-hole data (Tables 1 and 2) in conjunction with published gravity and aeromagnetic contour maps. The data are sufficient to determine the generalized outlines and shapes of the basins. The drill-hole data are from Costain and others (1986), Hansen and Edwards (1986), Hubbard and others (1978), Johnson (1975), Posner and Zenone (1983), and the Virginia Division of Mineral Resources's files. The onshore and Chesapeake Bay aeromagnetic data are from Zietz and others (1977) and the offshore aeromagnetic data are from the U.S. Geological Survey (1976). Onshore and Chesapeake Bay simple Bouguer gravity anomaly data are from Johnson (1977) and the offshore free-air gravity anomaly data are from the Society of Exploration Geophysicists (1982).

The writers wish to thank Albert J. Froelich, U.S. Geological Survey, for his comments and suggestions regarding the maps and manuscript.

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1989

GRAVITY MAP

PUBLICATION 94, PLATE 2
EXPOSED AND INFERRED EARLY MESOZOIC BASINS
ONSHORE AND OFFSHORE, VIRGINIA
GRAVITY MAP

A belt of fault-controlled rift basins of early Mesozoic age lies along the east coast of North America from Florida to the Grand Banks of Newfoundland (American Geological Institute, 1979). The basins of this Atlantic Coast rift system contain Upper Triassic and Lower Jurassic continental rocks of the Newark Supergroup. Basinal structures were formed as the earth's crust was arched upward and then extended as Africa began to separate from North America during the earliest phase of the opening of the Atlantic Ocean. Subsequent sedimentation, lithification, and erosion have left, in Virginia, Mesozoic basins exposed in the Piedmont and concealed to the east beneath the younger Mesozoic and Cenozoic sedimentary strata of the Coastal Plain.

In the Piedmont, the Mesozoic sedimentary basins may be grouped into western, central, and eastern belts (Figure 1; Wise and Johnson, 1980; Johnson, Wilkes, and Zeiler, 1985; Johnson, Wilkes, and Gwin, 1985; and Johnson, Wiener, and Conley, 1985). The Culpeper, Barboursville, Scottsville, and Danville basins make up the western belt; the Farmville basin and four smaller basins to the south constitute the central belt; and the eastern belt consists of the Taylorsville, Richmond, and five small subsidiary basins. All of the exposed basins trend north-northeast, generally parallel with the regional trend of the Appalachian orogen, and are found in and enclosed by, crystalline rocks of the Piedmont Province.

The rocks contained within the basins are generally of fluvial and lacustrine origin and include conglomerate, arkosic sandstone, siltstone, and shale, with minor beds of limestone and coal in most basins. Diabase and/or basalt dikes and sills are found within the sedimentary package of most of the basins. Igneous intrusive rocks are widespread also in the adjacent Piedmont crystalline rocks.

The areal extent of the Mesozoic rocks east of the Fall Line, buried beneath the Atlantic Coastal Plain and adjacent continental shelf sediments, is not known in detail. However, the approximate distribution of these buried basins has been deduced from the widely distributed drill holes that have penetrated the younger Cretaceous strata, suplimented by geophysical data. These holes were drilled over a period of many years for groundwater, hydrocarbons, and geothermal resource evaluation.

The exposed Richmond basin and the exposed part of the Taylorsville basin are on trend with drill holes in the Coastal Plain of Virginia and Maryland that have penetrated sedimentary rocks of probable early Mesozoic age (Hansen and Edwards, 1986; Hansen, 1988). Drillholes in King George County, Virginia (W-2252), and in Prince Georges County, Maryland probably intersected an extension of the Taylorsville basin buried beneath the Coastal Plain (MGS/CH-CE 37, WGL/ROBINSON #2, WGL/MUDD #3, and WGL/ROBERTS #2). This basin structure may be continuous into the Delmarva Peninsula which, in Maryland, Hansen (1988) has tentatively named the Queen Anne basin. He suggests that the basin could be part of an eastern belt of buried rift basins that follows the arcuate trend of the Appalachian orogen, emerging in Virginia as the Taylorsville and Richmond basins (Hansen, 1988).

Offshore Virginia rift basins, identified on the basis of seismic reflection profiles, have been discussed by Klitgord and Hutchinson (1985). The Norfolk basin, one of the basins identified by them, is about 75 miles offshore of southeastern Virginia. Bayer and Milici (1987) have interpreted seismic data for nine lines offshore Virginia and indicate that the Norfolk basin is probably divided in two by a horst-like structure of basement rocks.

In this study, the buried basins in the Virginia Coastal Plain were located by interpreting available drill-hole data (Tables 1 and 2) in conjunction with published gravity and aeromagnetic contour maps. The data are sufficient to determine the generalized outlines and shapes of the basins. The drill-hole data are from Costain and others (1986), Hansen and Edwards (1986), Hubbard and others (1978), Johnson (1975), Posner and Zenone (1983), and the Virginia Division of Mineral Resources's files. The onshore and Chesapeake Bay aeromagnetic data are from Zietz and others (1977) and the offshore aeromagnetic data are from the U.S. Geological Survey (1976). Onshore and Chesapeake Bay simple Bouguer gravity anomaly data are from Johnson (1977) and the offshore free-air gravity anomaly data are from the Society of Exploration Geophysicists (1982).

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KEY

Early Mesozoic basins

Exposed basins

Buried basins

Drill holes

Drill hole encountering Triassic rock (Table 1)

Drill hole encountering pre-Triassic crystalline basement rock (Table 2)

- 25

Onshore and Chesapeake Bay

Simple Bouguer anomaly contour (isogal), hachured to indicate closed areas of lower gravity; contour interval 5 milligals; reduction density 2.67 gm/cm; datum 980118.000 milligals; no terrain correction.

- 40

Offshore

Free air anomaly contour (isogal); hachured to indicate closed areas of lower gravity; contour interval 5 milligals; datum is based on the International Gravity Standardization Net of 1971 and the 1967 Geodetic Reference System formula for theoretical gravity.

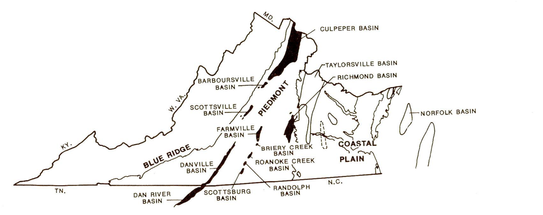

Figure 1. Location of Early Mesozoic basins in Virginia; Richmond basin includes Deep Run, Tuckahoe, Union, and Stonehenge basins. Dashed basin outline indicates location of probable basin.

Scale 1:500,000

10 0 10 20 30 40 Miles

10 0 10 20 30 40 50 Kilometers

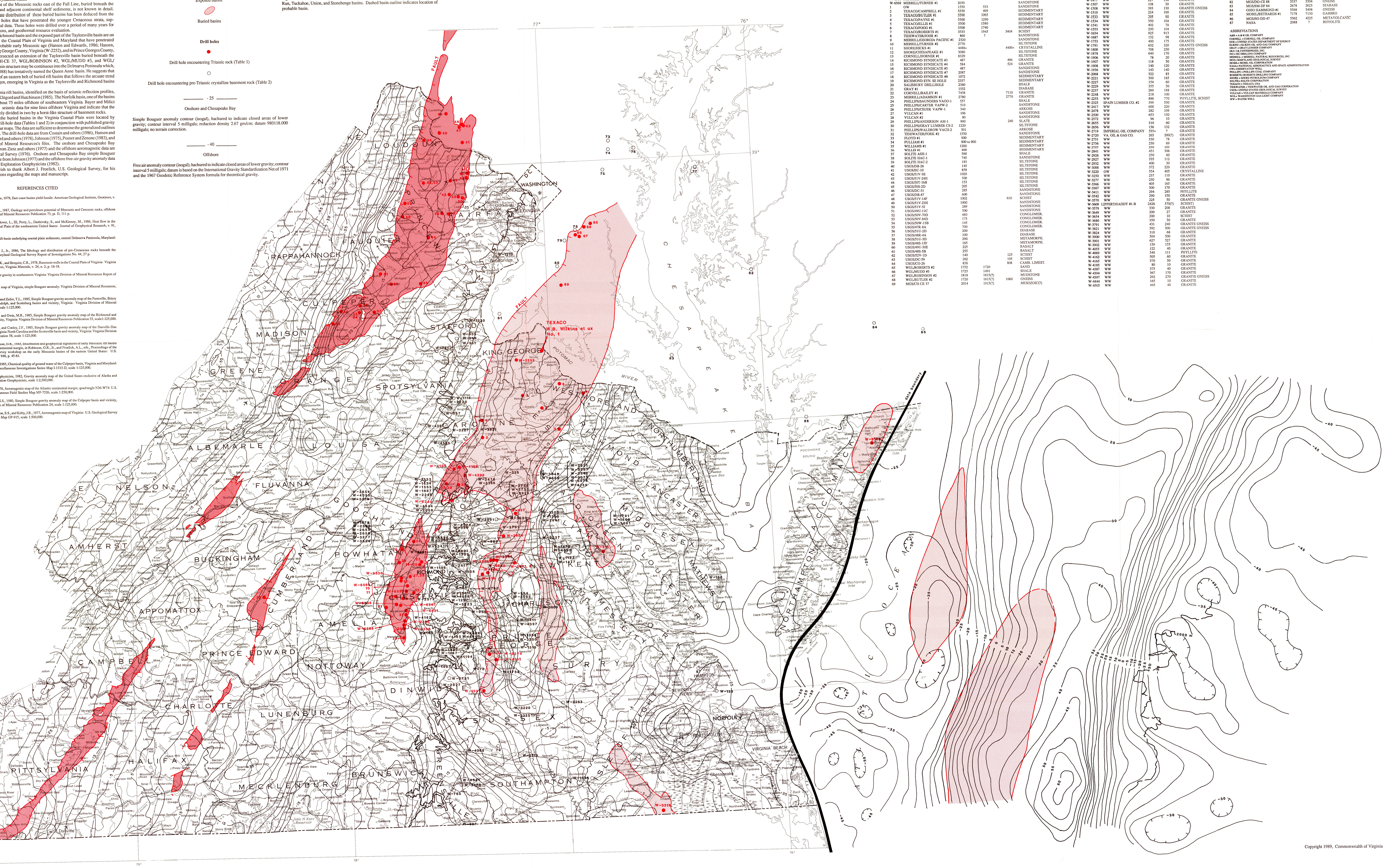

Table 1. Drill holes encountering Early Mesozoic rocks.

INDEX NUMBER	DRILL HOLE NAME	TD (FEET)	CRETACEOUS MESOZOIC CONTACT(FEET)	BASEMENT (FEET)	TD LITHOLOGY
W-457	ROBERTS/TOWNSEND #1	3278	1009	2609	GNEISS
W-515	WW	1689	1320		SANDSTONE
W-616	WW	712	249		SANDSTONE
W-1921	WW	440	90		ARKOSE
W-2071	WW	652	640		SANDSTONE
W-2252	JSC/THOMPSON #1	3307	2210	3297(?)	BASALT
W-2335	A&R/MARTIN #1A	620			SANDSTONE
W-2336	A&R/MARTIN #1B	520			SANDSTONE
W-2340	WW	325			SANDSTONE
W-2683	WW	540	510		SANDSTONE
W-3180	J&J/TAYLOR #1-G	6279	5006	6134	SCHIST
W-3316	OW	2017	1920		SANDSTONE
W-3374	WW	325	100		MUDSTONE
W-3443	WW	340	220		SANDSTONE
W-3574	WW	610	460		SANDSTONE
W-3903	WW	404	280		MUDSTONE
W-3904	WW	600	512		MUDSTONE
W-4159	WW	297	37		MUDSTONE
W-4160	WW	370	50		MUDSTONE
W-4208	WW	420	229		MUDSTONE
W-4591	WW	220	210		MUDSTONE
W-6529	MERRILL/HUDGINS #1	2700			SILTSTONE
W-6530	MERRILL/GORDON #1	1820			SANDSTONE
W-6531	MERRILL/CASHION #2	1675		1620	CRYSTALLINE
W-6538	MERRILL/CONTINENTAL CAN #1	2700			"GRAVEL"
W-6567	MERRILL/CONTINENTAL CAN #4	2700			SANDSTONE
W-6568	MERRILL/CHALKLEY #1	1510		1190	CRYSTALLINE
W-6569	MERRILL/TURNER #1	2030			SANDSTONE
1	OW	1550	533		SANDSTONE
2	TEXACO/CAMPBELL #1	5550	499		SEDIMENTARY
3	TEXACO/BUTLER #1	5500	1065		SEDIMENTARY
4	TEXACO/PAYNE #1	5500	1290		SEDIMENTARY
5	TEXACO/ELLIS #1	5500	1580		SEDIMENTARY
6	TEXACO/FOGG #1	5500	1740		SEDIMENTARY
7	TEXACO/ROBERTS #1	3533	1945	3404	SCHIST
8	TIDEWATER/JOHR #1	860	?		SANDSTONE
9	MERRILL/GEORGIA PACIFIC #1	2320			SANDSTONE
10	MERRILL/TURNER #2	2770			SILTSTONE
11	SHORE/HICKS #1	4488+		4400+	CRYSTALLINE
12	SHORE/CHESAPEAKE #1	3080			SILTSTONE
13	CORNELL/HORNER #1	6329			SILTSTONE
14	RICHMOND SYNDICATE #3	487		486	GRANITE
15	RICHMOND SYNDICATE #4	584		524	GRANITE
16	RICHMOND SYNDICATE #5	487			SANDSTONE
17	RICHMOND SYNDICATE #7	2087			SANDSTONE
18	RICHMOND SYNDICATE #8	1072			SEDIMENTARY
19	RICHMOND SYN. SE HOLE	2337			SEDIMENTARY
20	SALISBURY DRILLHOLE	2380			SHALE
21	GRAY #1	1552			DIABASE
22	CORNELL/BAILEY #1	7438		7110	GRANITE
23	MERRILL/ADAMSON #1	2780		2770	GRANITE
24	PHILLIPS/SAUNDERS VAGO-1	557			SHALE
25	PHILLIPS/CARTER VAPW-2	510			SANDSTONE
26	PHILLIPS/CIEJEK VAPW-1	340			ARKOSE
27	VULCAN #1	106			SANDSTONE
28	VULCAN #2	80			SANDSTONE
29	PHILLIPS/ANDERSON AM-1	900		240	SLATE
30	PHILLIPS/GRAY LUMBER CS-2	1220			SILTSTONE
31	PHILLIPS/WALDROW VACH-2	501			ARKOSE
32	TIDEWATER/FORK #2	1550			SANDSTONE
33	FLOYD #1	900			SEDIMENTARY
34	PULLIAM #1	800 to 900			SEDIMENTARY
35	WILLIAMS #1	1200			SEDIMENTARY
36	WILLIS #1	400			SEDIMENTARY
37	SOLITE ASH-1	560			SHALE
38	SOLITE HAC-1	745			SANDSTONE
39	SOLITE HAC-2	183			SILTSTONE
40	USGS/DB-26	145			SILTSTONE
41	USGS/EC-10	858			SILTSTONE
42	USGS/51V-3E	1020			SILTSTONE
43	USGS/51V-24H	500			SILTSTONE
44	USGS/50T-16B	153			SILTSTONE
45	USGS/50S-2D	205			SILTSTONE
46	USGS/DC-31	285			SANDSTONE
47	USGS/DB-47	600			SANDSTONE
48	USGS/51V-14F	1002		610	SCHIST
49	USGS/51V-23H	1000			SANDSTONE
50	USGS/51V-5J	289			SANDSTONE
51	USGS/49U-11C	500			SANDSTONE
52	USGS/50V-70D	480			CONGLOMER.
53	USGS/50V-84D	175			CONGLOMER.
54	USGS/50W-13B	145			CONGLOMER.
55	USGS/47R-8A	700			CONGLOMER.
56	USGS/51U-2D	200			DIABASE
57	USGS/48R-4A	100			DIABASE
58	USGS/51U-3D	290			METAMORPH.
59	USGS/48S-15F	165			METAMORPH.
60	USGS/49U-30E	225			BASALT
61	USGS/48S-5B	255			BASALT
62	USGS/52V-1D	140		125	SCHIST
63	USGS/DC-59	262		105	SCHIST
64	USGS/CO-26	858		808	CAMB. LIMEST.
65	WGL/ROBERTS #2	1752	1720		SAND
66	WGL/MUDD #3	1725	1491		SHALE
67	WGL/ROBINSON #2	1818	1815(?)		MUDSTONE
68	WGL/BUTLER #2	1720	1615(?)	1660	GNEISS
69	MGS/CH-CE 37	2014	1915(?)		MESOZOIC(?)

Table 2. Basement drill holes.

INDEX NUMBER	DRILL HOLE NAME	TD (FEET)	BASEMENT (FEET)	TD LITHOLOGY
W-56	WW	425	71	GRANITE
W-70	WW	173	170	GRANITE
W-158	FORT MONROE	2255	2246	GRANITE
W-180	ELKINS/PHILLIPS #1	2325	2307	GRANITE
W-335	WW	306	227	GRANITE
W-539	WW	239	26	GRANITE GNEISS
W-584	WW	300	250	GRANITE
W-587	WW	297	70	GRANITE GNEISS
W-763	WW	265	60	MARBLE
W-781	WW	226	185	GRANITE GNEISS
W-935	WW	199	150	GRANITE
W-953	WW	350	180	GRANITE
W-960	WW	325	125	GRANITE
W-961	WW	475	275	GRANITE
W-969	WW	608	276	GRANITE
W-997	WW	220	44	GRANITE
W-1116	WW	318	145	GRANITE
W-1123	WW	262	257	GRANITE
W-1187	WW	126	100	GRANITE
W-1194	WW	175	95	GRANITE
W-1198	WW	600	50	GRANITE
W-1210	WW	577	90	GRANITE GNEISS
W-1230	WW	295	210	GRANITE
W-1297	WW	234	158	GRANITE
W-1300	WW	334	290	GRANITE
W-1305	WW	508	200	GRANITE
W-1388	WW	525	324	GRANITE
W-1472	WW	395	260	GRANITE
W-1477	WW	227	190	GRANITE
W-1507	WW	108	30	GRANITE
W-1508	WW	393	130	GRANITE GNEISS
W-1510	WW	224	160	GRANITE
W-1533	WW	295	90	GRANITE
W-1534	WW	350	104	GRANITE
W-1541	WW	402	70	GRANITE
W-1553	WW	230	104	GRANITE
W-1634	WW	925	913	GRANITE
W-1687	WW	132	98	GRANITE
W-1753	WW	400	175	GRANITE
W-1791	WW	632	320	GRANITE GNEISS
W-1800	WW	708	250	GRANITE
W-1878	WW	640	170	GRANITE
W-1906	WW	78	20	GRANITE
W-1907	WW	118	50	GRANITE
W-1908	WW	140	120	GRANITE
W-1936	WW	143	140	GRANITE
W-2068	WW	322	83	GRANITE
W-2221	WW	300	185	GRANITE
W-2227	WW	154	60	GRANITE
W-2229	WW	355	50	GRANITE
W-2237	WW	260	188	GRANITE
W-2248	WW	218	100	GRANITE
W-2253	WW	886	770	PHYLLITE, SCHIST
W-2325	SPAIN LUMBER CO. #2	599	530	GRANITE
W-2417	WW	600	220	GRANITE
W-2478	WW	282	109	GRANITE
W-2500	WW	653	150	GRANITE
W-2572	WW	96	10	GRANITE
W-2655	WW	310	60	GRANITE
W-2656	WW	136	132	GRANITE
W-2719	IMPERIAL OIL COMPANY	535+	?	GRANITE
W-2720	VA. OIL & GAS CO.	265	200(?)	GRANITE
W-2751	WW	330	78	GRANITE
W-2756	WW	250	69	GRANITE
W-2757	WW	250	103	GRANITE
W-2841	WW	451	306	GRANITE
W-2926	WW	250	60	GRANITE
W-2927	WW	335	112	GRANITE
W-2932	WW	400	30	GRANITE
W-3088	WW	372	220	GRANITE
W-3220	OW	554	405	CRYSTALLINE
W-3250	WW	237	110	GRANITE
W-3277	WW	250	86	GRANITE
W-3366	WW	405	165	GRANITE
W-3367	WW	300	170	GRANITE
W-3411	WW	294	285	PHYLLITE
W-3542	WW	290	150	GRANITE
W-3570	WW	225	50	GRANITE GNEISS
W-3609	LIPPERT/GADDY #1-B	2426	570(?)	SCHIST)
W-3579	WW	330	200	GRANITE
W-3649	WW	200	27	GRANITE
W-3654	WW	200	10	SCHIST
W-3680	WW	350	50	GRANITE
W-3791	WW	431	240	GRANITE GNEISS
W-3821	WW	592	300	GRANITE GNEISS
W-3824	WW	310	68	GRANITE
W-3900	WW	504	500	GRANITE
W-3901	WW	627	527	GRANITE
W-3902	WW	159	155	GRANITE
W-4055	WW	122	40	GRANITE
W-4069	WW	340	111	PHYLLITE
W-4162	WW	505	60	GRANITE
W-4165	WW	370	50	GRANITE
W-4185	WW	80	10	GRANITE
W-4387	WW	375	40	GRANITE
W-4394	WW	367	170	GRANITE
W-4397	WW	292	270	GRANITE GNEISS
W-4444	WW	165	10	GRANITE
W-4505	WW	445	40	GRANITE
W-4540	WW	240	40	GRANITE
W-4541	WW	206	60	METASLTSTONE
W-4762	WW	205	125	GRANITE
W-4890	WW	318	313	GRANITE
W-4894	WW	190	50	GRANITE
W-4906	WW	92	20	GRANITE
W-5019	WW	250	20	GRANITE
W-5078	WW	632	109	GRANITE
W-5081	WW	402	220	GRANITE
W-5139	WW	357	60	GRANITE
W-5191	WW	400	50	GRANITE
W-5223	WW	360	110	GRANITE
W-5341	WW	357	60	GRANITE
70	DOE/PT1	832	300	GRANITE
71	DOE/C25A	2009	1800	GRANITE
72	DOE/C26	1628	1380	GRANITE
73	MGS/AA-CC 78	917	908	GNEISS
74	MGS/AA-CC 114	1025	1017	GNEISS
75	MGS/PG-CF 53	1172	1162	GRANITE
76	MGS/AA-CE 120	1340	1290	FELSIC
77	MGS/QA-EB 110	2548	2518	WEATHERED
78	WGL/DENNISON #3	1743	1707	GNEISS
79	WGL/THORNE #2	1478	1433	GNEISS
80	MGS/CH-BE 57	1802	1791	SCHIST
81	MGS/CH-DA 6	886	882	SCHIST
82	MGS/DO-CE 88	3337	3304	GNEISS
83	MGS/SM-DF 84	2678	2623	DIABASE
84	OHIO HAMMOND #1	5568	5498	GNEISS
85	MOBIL/BETHARDS #1	7178	7130	GABBRO
86	MGS/SO-DD 47	5562	4225	METAVOLCANIC
87	NASA	2088	?	RHYOLITE

ABBREVIATIONS

A&R = A & R OIL COMPANY
CORNELL = CORNELL OIL COMPANY
DOE = UNITED STATES DEPARTMENT OF ENERGY
ELKINS = ELKINS OIL AND GAS COMPANY
GRAY = GRAY LUMBER COMPANY
J&J= J & J ENTERPRISES, INC.
JSC= JSC DRILLING COMPANY
MERRILL = MERRILL NATURAL RESOURCES, INC.
MGS= MARYLAND GEOLOGICAL SURVEY
MOBIL= MOBIL OIL CORPORATION
NASA= NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OW= OBSERVATION WELL
PHILLIPS = PHILLIPS COAL COMPANY
ROBERTS= ROBERTS DRILLING COMPANY
SHORE = SHORE PETROLEUM COMPANY
SOLITE= SOLITE CORPORATION
TEXACO = TEXACO, USA
TIDEWATER = TIDEWATER OIL AND GAS CORPERATION
USGS= UNITED STATES GEOLOGICAL SURVEY
VULCAN = VULCAN MATERIALS COMPANY
WGL= WASHINGTON GAS LIGHT COMPANY
WW = WATER WELL

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